



IEEE

MAG-33 MAGNETICS SOCIETY
THE INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS, INC.
1515 W. 190th STREET, SUITE 530
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MAG-33 MAGNETICS SOCIETY LOS ANGELES COUNCIL

6:00 P.M. DINNER OLIVE GARDEN ITALIAN RESTAURANT,
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PARKING: PLAZA PASADENA (NO CHARGE UNDER BROADWAY & J.C. PENNEYS),
ENTER at EUCLID from the North or South, Aisle B3 or C3 or any open parking spaces.

8:00 P.M. MEETING: *please note new location:*

CALTECH MOORE HALL Room 070 Sub Basement Lecture Hall.

PARKING: DEL MAR BLVD. TO MICHIGAN', SOUTH TO PARKING ON LEFT BEHIND
BECKMAN AUDITORIUM THEN EAST TO MOORE HALL.

* • JANUARY 15 MEETING • *
* * * THE CASSINI SPACECRAFT REACTION WHEEL PERMANENT MAGNET MOTOR * * *
* * PRESENTED BY JOHN F. SOUTH * *

The Cassini spacecraft utilizes four reaction wheels to store and transfer angular momentum during maneuvers without expending consumable propellants. The parameters of the Cassini mission to Saturn require the reaction wheels to be highly reliable, electrically and mechanically efficient, with accuracy, smoothness, and time resolution of the torque and stored angular momentum. The Cassini spacecraft is scheduled for launch on its mission to explore the rings of Saturn in October 1997.

The Cassini spacecraft reaction wheels have a strong heritage from other successful spacecraft, with some enhancements for Cassini. Additionally, the command and data interface is a bi-directional 1553 serial data bus that is the spacecraft standard for data communication. Of particular interest is the wheel drive motor that provides the torque couple between the reaction wheel and the spacecraft inertia tensor. The stator contains the field coils hard wired to the electronics, which couple through their magnetic fields to the multi-pole array of permanent magnets in the rotor structure. A very elegant design produces very smooth acting torques while maintaining high efficiency. This talk will be of interest to anyone who uses DC motor controls.

BIOGRAPHY

John F. South is a member of the technical staff at the Jet Propulsion Laboratory, California Institute of Technology.

ROBERT E. HILL, P.E.

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*** * -PRESENTED BY JOHN F. SOUTH * ***

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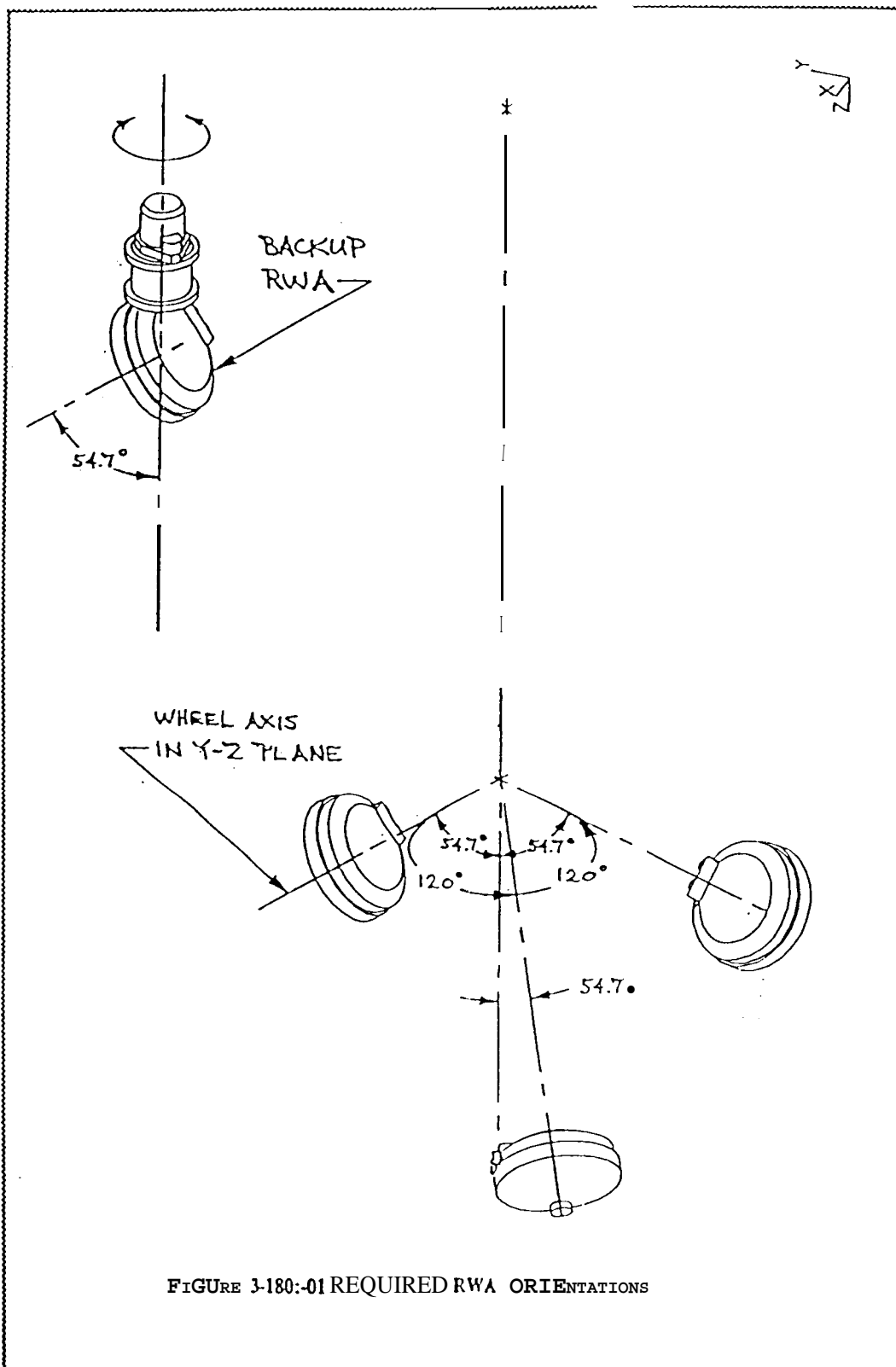


FIGURE 3-180:-01 REQUIRED RWA ORIENTATIONS

PRELIMINARY CASSINI RWM CROSS-SECTION

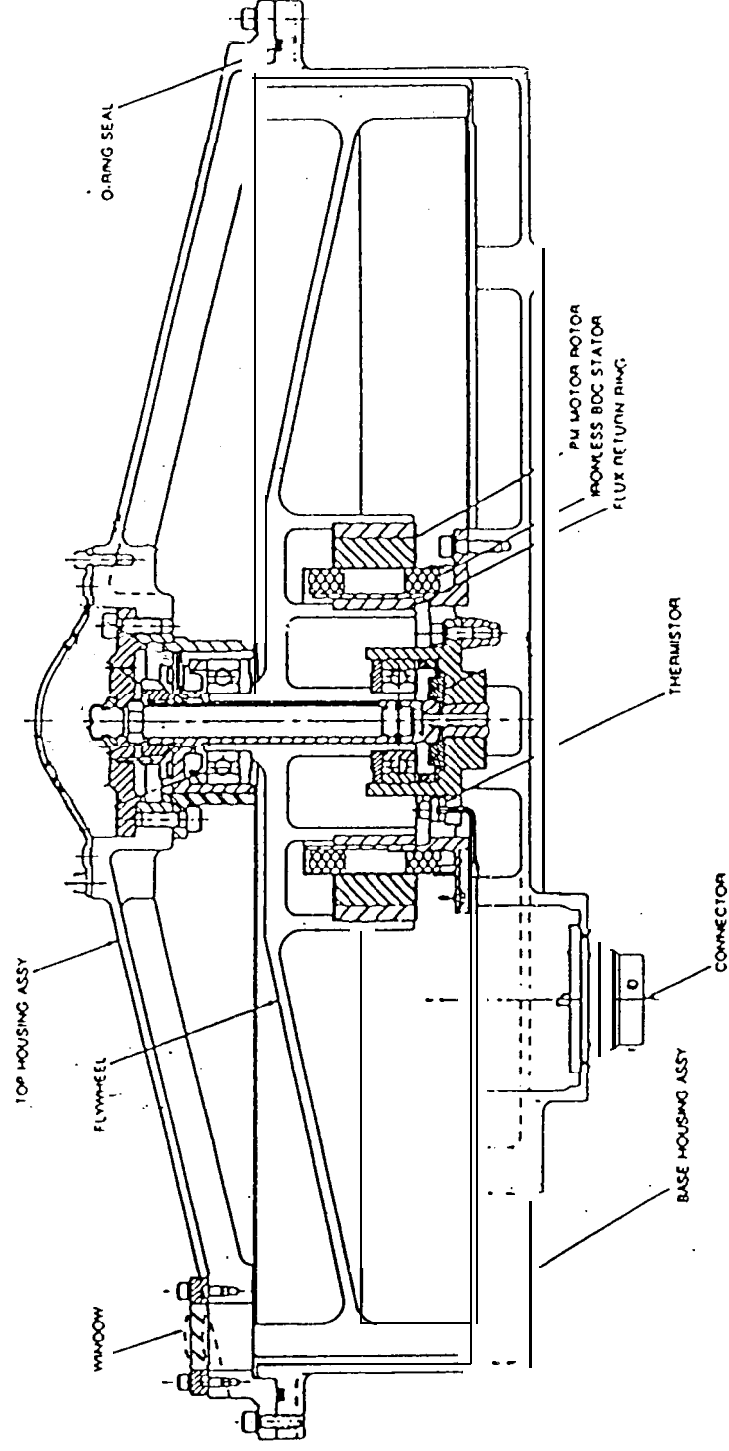
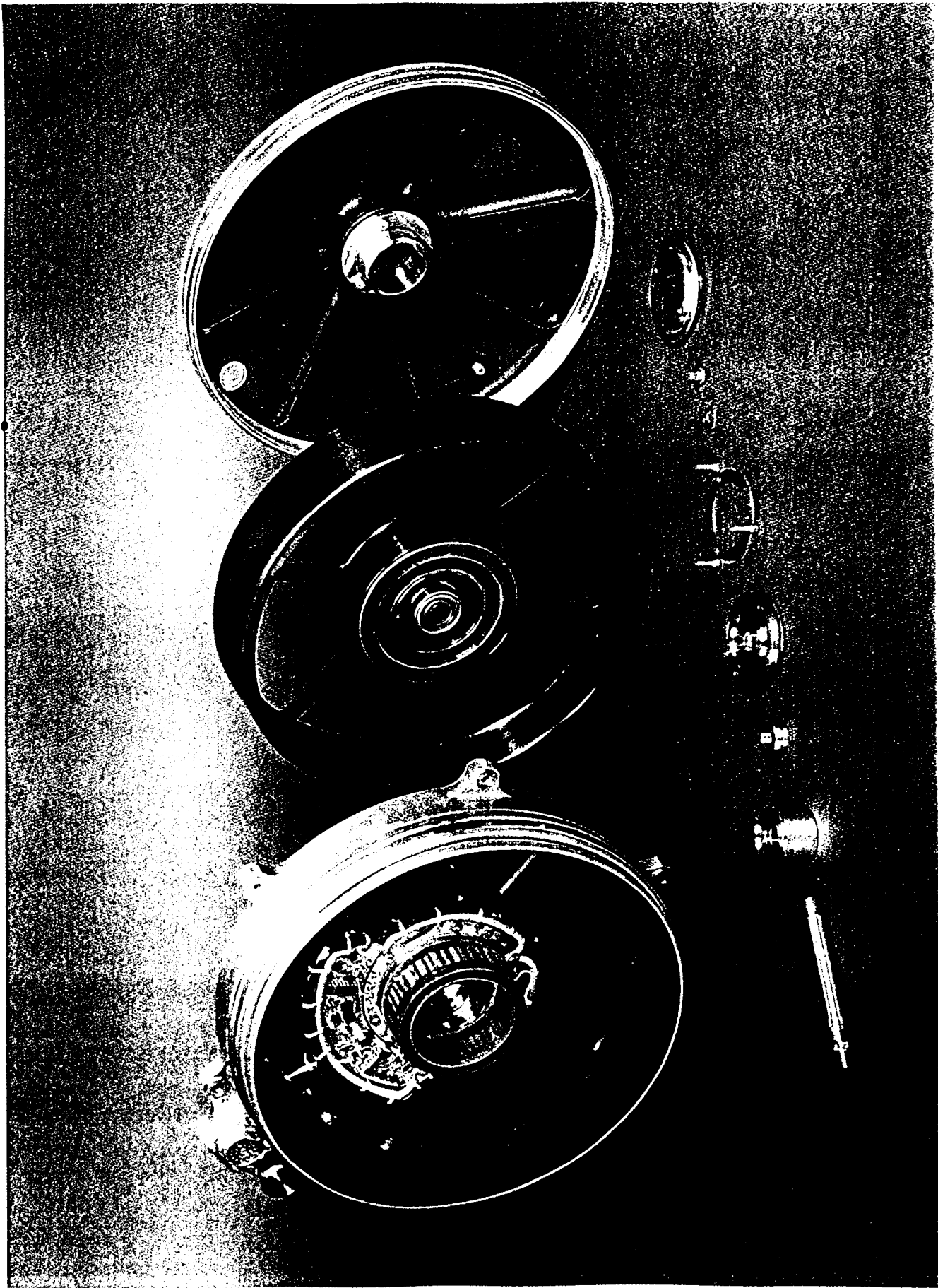
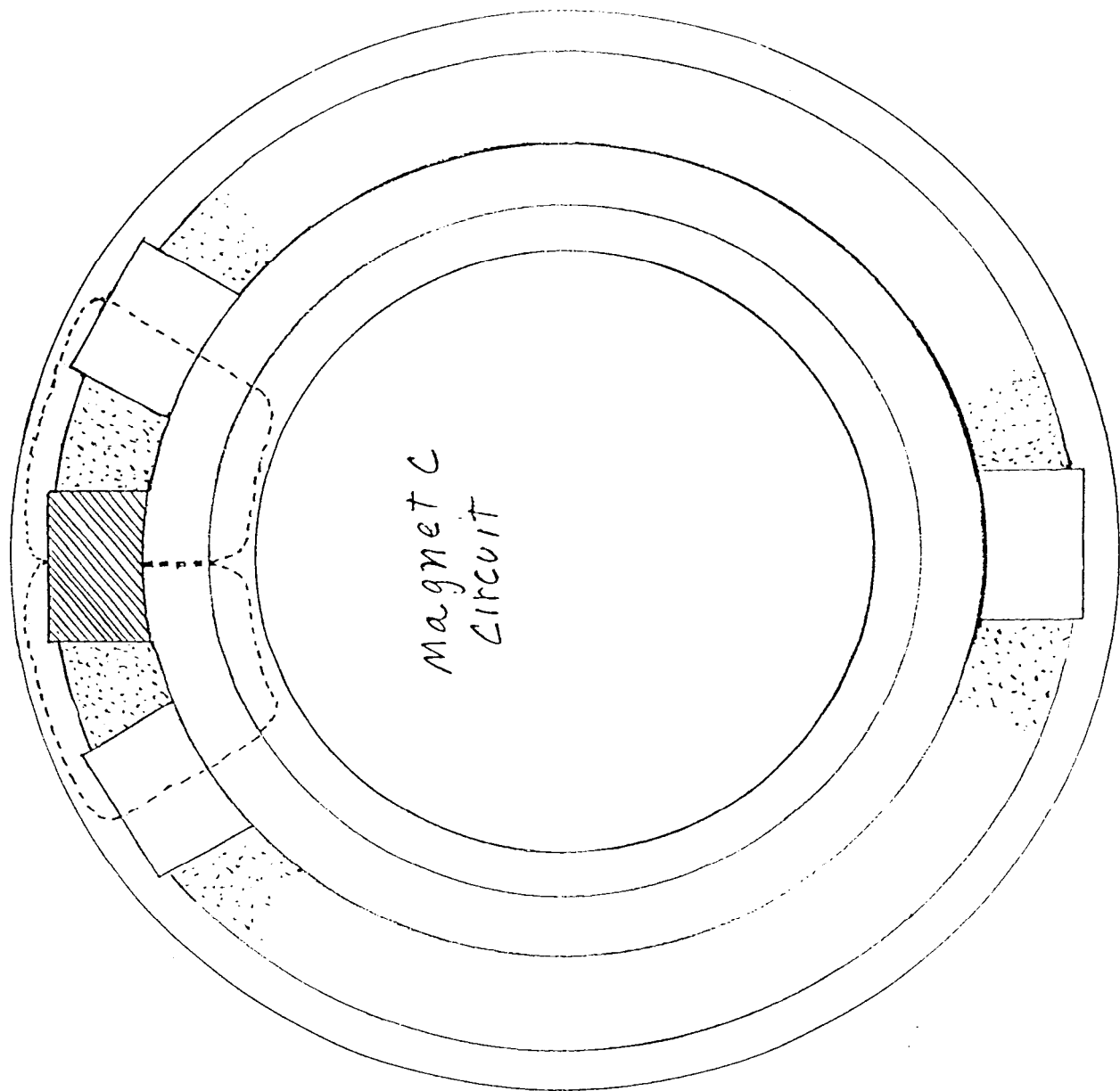


Figure 2. Wheel and bearing cross section



**Allied
Signal**



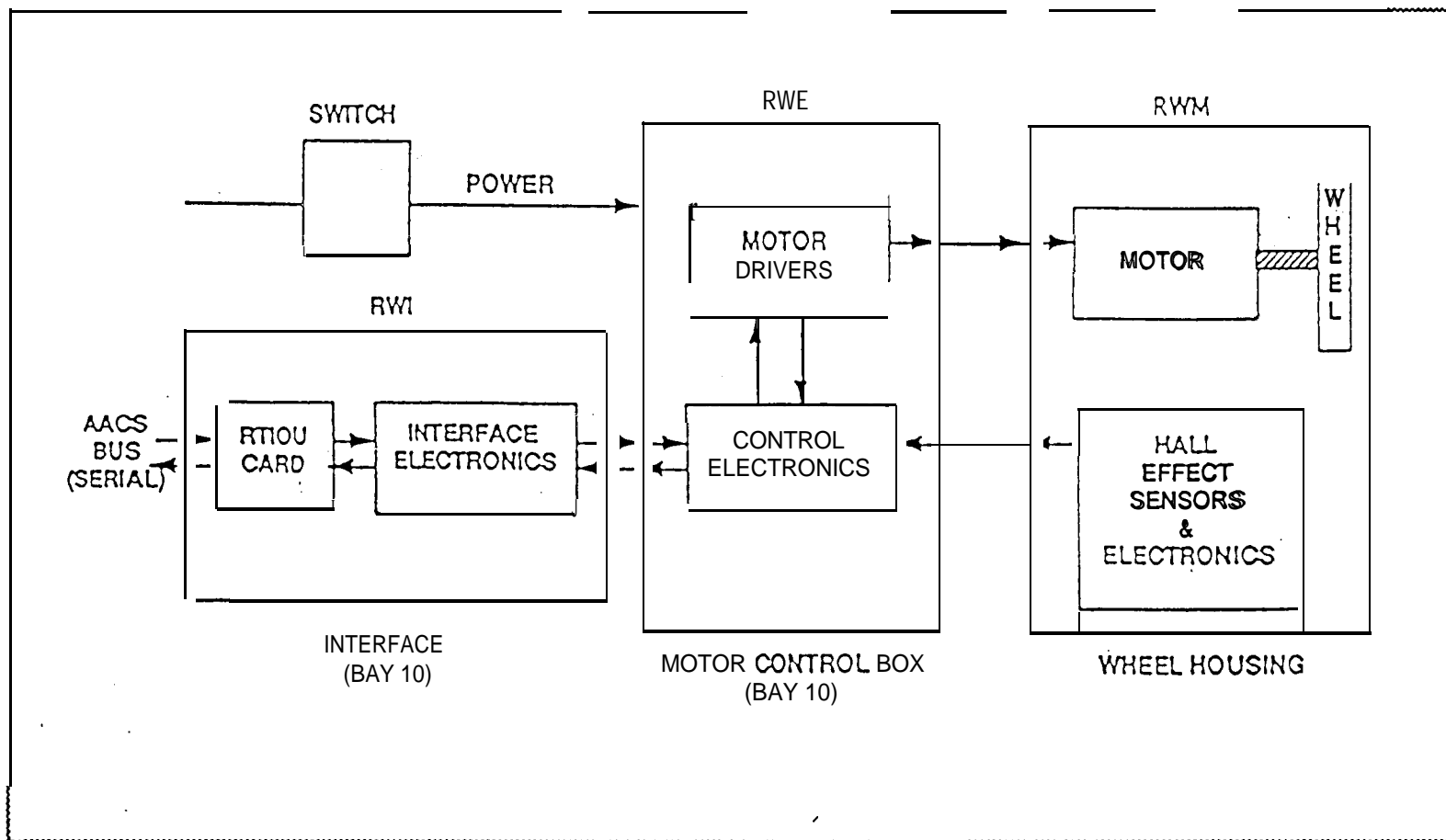


Figure 1. Cassini Reaction Wheel Block Diagram (4 Wheels Total)

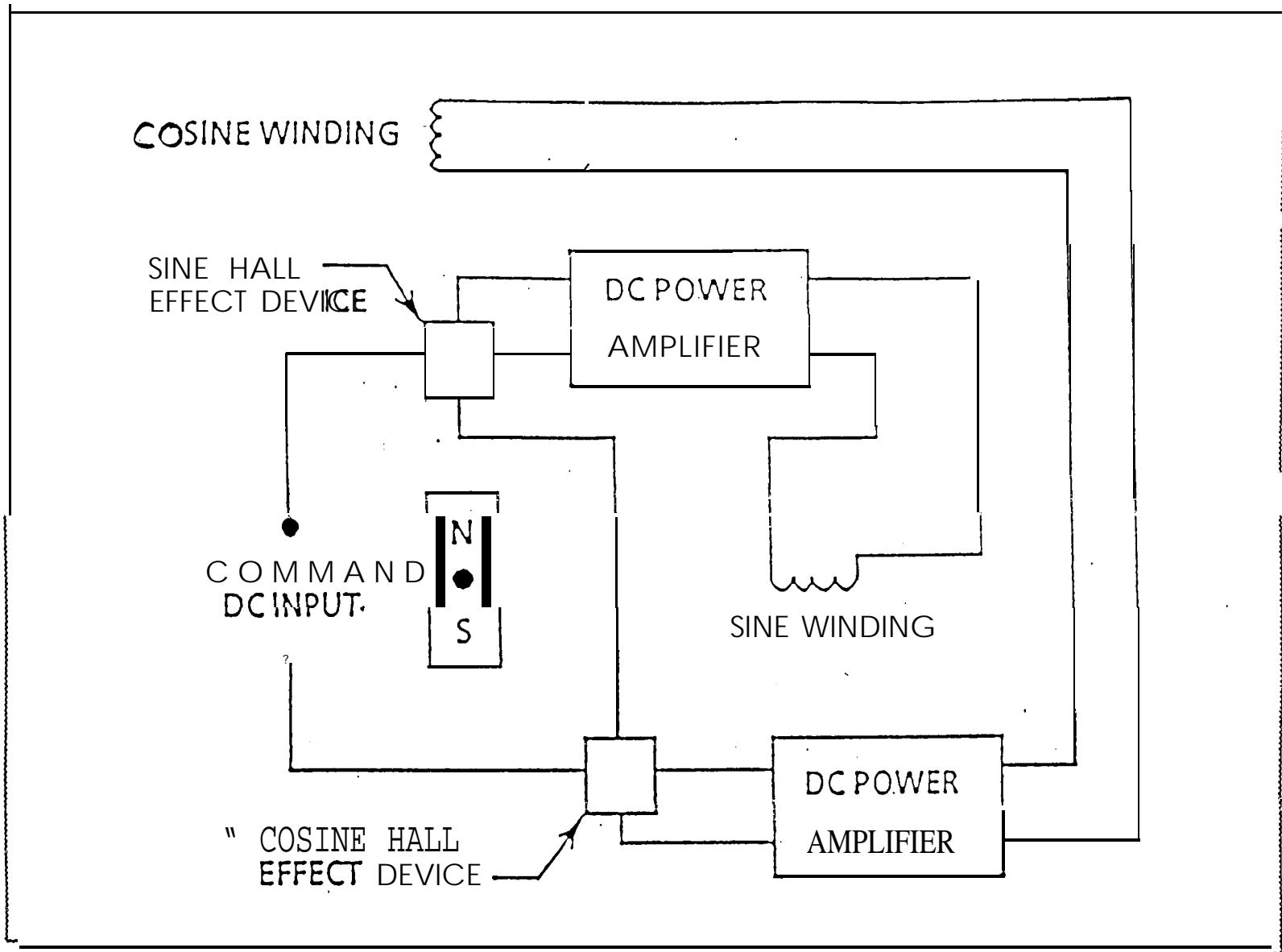


Figure 5. Motor Block Diagram

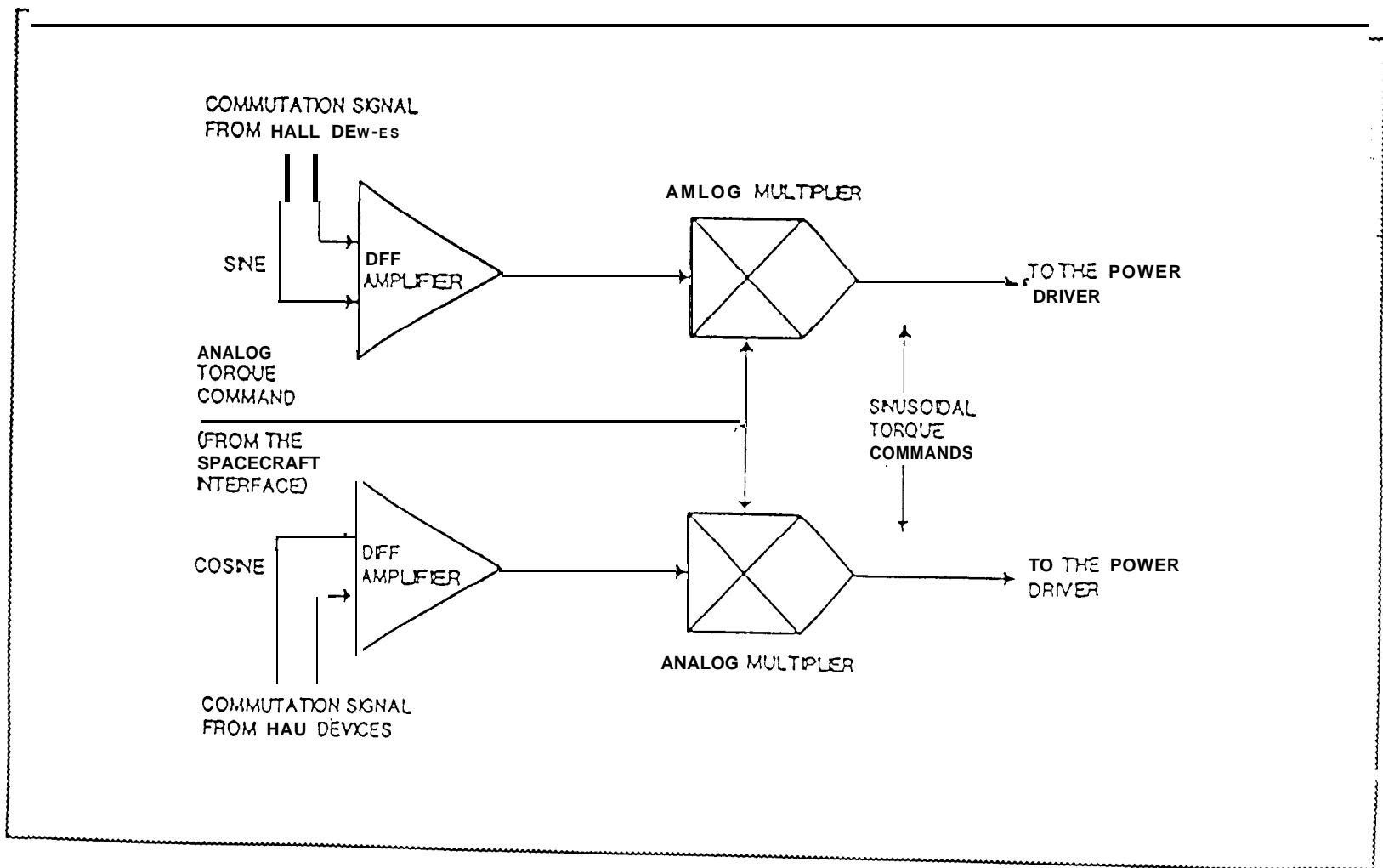


Figure 9. Commutation and Torque Command

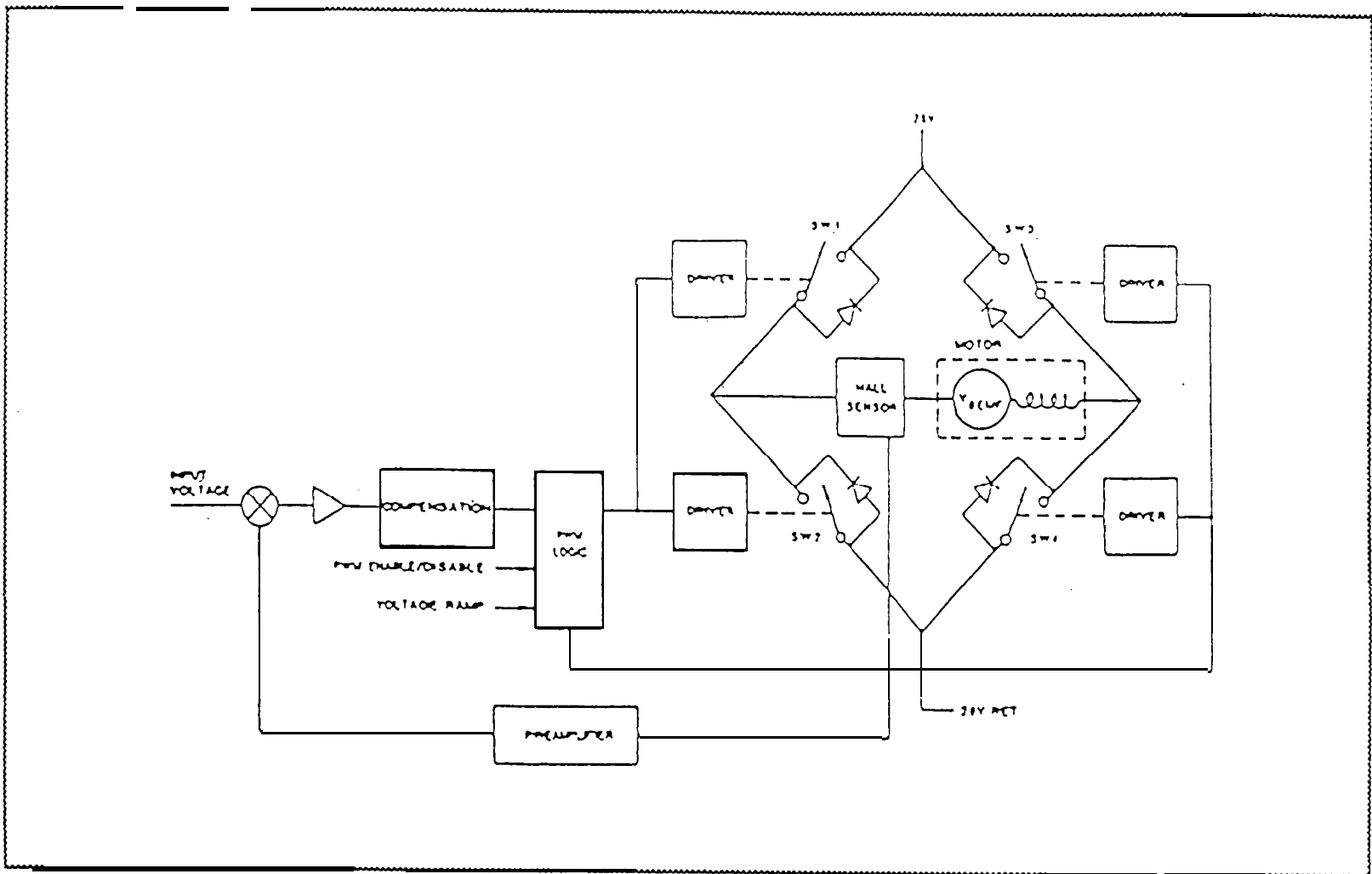


Figure 8. PWM Motor Drive Circuit

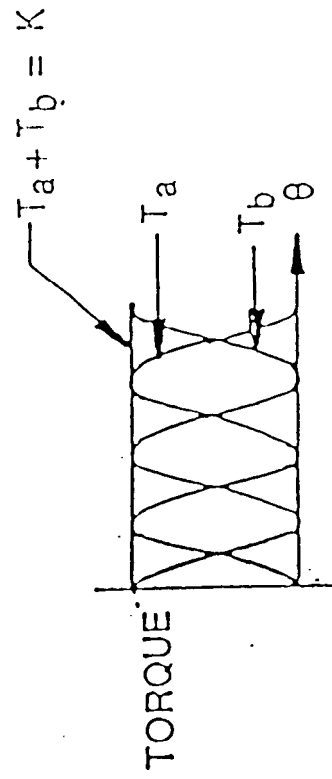
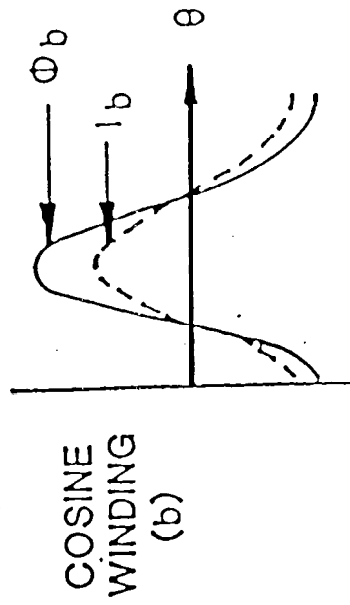
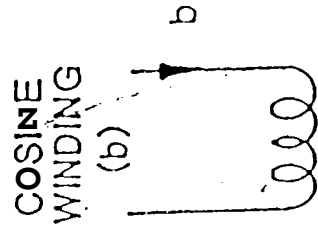
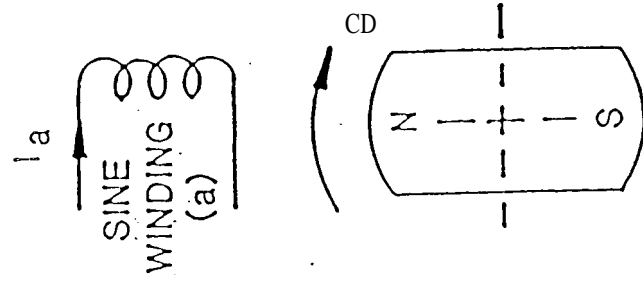
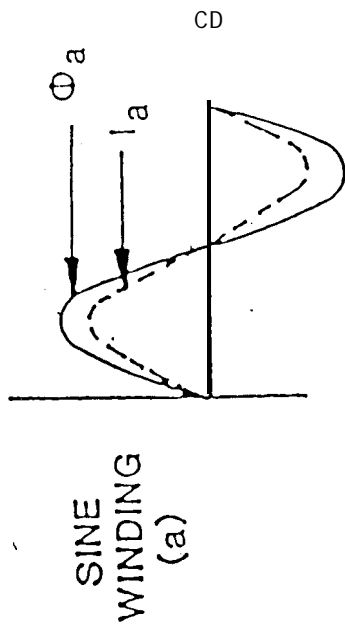


Table 3
Brushless DC Motor Parameters

Speed Range	$\pm 2,200$ rpm
R-action Torque	2.2 oz-in
Machine Constant	15 oz-in/ \sqrt{W}
Back EMF Constant (per phase)	10 volts pk/K rpm
Torque Constant (per phase)	13 oz-in/amp pk
Resistance (per phase)	0.7 ohm
Number of P h a s e s	2
Number of Poles	12
Number of Hall Generators	2
Outside Diameter	4.4 inches
Inside Diameter	2.5 inches
Overall Length	1.8 inches
Motor Weight	2.0 pounds